

STUDENTS' UNDERSTANDING ABILITY IN SOLVING ALGEBRAIC PROBLEMS

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Abstract

The purpose of this study was to analyze the understanding abilities of mathematics students in solving algebraic problems based on how to answer them. The study sample consisted of 46 odd semester students of class 2018 in one of the private universities (PTS), Cimahi. The research method used is descriptive qualitative method that seeks to describe the completion analysis of students in answering algebraic questions. Data processing uses the correct percentage of student answers. The results of this study found that there were still many mathematical students who were mistaken in solving algebraic problems so that students' comprehension skills were still at a low level (50.54%) with indicators identifying the characteristics of a concept and recognizing the conditions that determine a concept that students still cannot master and overall because students do not understand the concept of algebra in depth, which is due to the meaninglessness of the learning process that is passed.

Keywords: understanding ability, mathematics students, algebra problems

Abstrak

Tujuan penelitian ini adalah untuk menganalisis kemampuan pemahaman mahasiswa matematika menyelesaikan soal aljabar berdasarkan cara menjawabnya. Sampel penelitian terdiri dari 46 mahasiswa semester ganjil angkatan 2018 di salah satu perguruan tinggi swasta (PTS), Cimahi. Metode penelitian yang dilakukan yakni metode deskriptif kualitatif yang berupaya untuk mendeskripsikan analisis penyelesaian mahasiswa dalam menjawab soal aljabar. Pengolahan datanya menggunakan presentase jawaban siswa yang benar. Hasil penelitian ini diperoleh masih banyak mahasiswa matematika yang keliru dalam menyelesaikan soal aljabar sehingga kemampuan pemahaman mahasiswa masih berada pada tingkat rendah (50,54%) dengan indikator mengidentifikasi sifat-sifat suatu konsep dan mengenal syarat yang menentukan suatu konsep masih belum bisa dikuasai mahasiswa dan secara keseluruhan dikarenakan mahasiswa tidak memahami konsep aljabar secara mendalam, yang disebabkan adanya ketidakbermaknaan proses pembelajaran yang dilalui.

Kata Kunci: kemampuan pemahaman, mahasiswa matematika, soal aljabar

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INTRODUCTION

Education in general is everyone's need, because without education someone can be considered one-eyed or not valued by others. This becomes a reference for everyone to have or feel education in both formal and informal education. In line with the opinion of Muhardi (2004) who said that in the face of increasingly fierce competition and increasing environmental uncertainty in the future, qualified human resources are needed, and therefore one of the efforts that must be prioritized in improving the quality of the nation in terms of the quality of human resources it is through education. This was confirmed by Setiawan & Sari (2019) which states that mathematics education has a significant role in the effort to create qualified human resources as capital for the development process. A person can be considered educated after going through the learning process. Overall learning for everyday life, namely learning mathematics. In line with opinion Hanipa & Sari (2018) which states that mathematics is a basic science that has a very important role in the life process, besides that it is supported by Y, Dassa, & Asdar (2015) also states that mathematics is formed from human experience that is processed in the world of ratios, processed in an analysis with reasoning in cognitive structures so that mathematical concepts are formed so that the mathematical concepts formed are easily understood by others and can be manipulated appropriately, then used in mathematical language or mathematical notation that is of global value. Learning mathematics is considered to be useful for dealing with everyday problems because without mathematics everyone is not able to recognize calculations (numbers) and even forms that make their own beauty, unable to do works of art, and unable to develop technology like now. This is in line with Agustina (2016) those who think about mathematics as one of the basic sciences, both its applied aspects and reasoning aspects, have an important role in the effort to master science and technology. Therefore, learning mathematics is very important in dealing with the problems of everyday life even for mastering science and technology in the industrial era 4.0 towards 5.0.

The basis for being able to master mathematics learning is to master the underlying knowledge of mathematics itself. The basic science that is important for mastering mathematics is algebra. In line with this, Kusaeri(Y., Andi Y, et al., 2015) states that algebra is very important in shaping children's mathematical character, because with algebra children are trained to think numerically, critically, creatively, reasoning and abstract thinking. So that it can be concluded if a person can understand or master algebra then he will be able to master other material related to mathematics. This was confirmed by Sari et al., (2016) that the keyword that is the beginning of the success of mathematics learning is mathematical understanding. How to master algebra by having the ability to understand or basic abilities that a person must have before mastering reasoning abilities and other abilities. It should be noted that the indicators of comprehension ability in this study have four of the seven indicators available, similar to the references in the study Suswigi & Zhanty (2019) namely 1) defining concepts verbally and writing, 2) identifying and making examples and not examples, 3) using models, diagrams and symbols to present a concept and 4) identifying the characteristics of a concept and recognizing the conditions that determine a concept .

But in reality, there are still those who have not mastered this understanding ability. So it is difficult to follow other mathematical material. One indicator of students has not mastered the ability to understand because they do not understand the concepts of the material being taught. The concept of a material is key so that students are able to master understanding skills. Therefore, opinions Armianti et al. (2016) explained that educators need perseverance, perseverance and thoroughness in putting concepts into students. The effort that must be sought by an educator is not just to stop until the school level, but it must be continued up to the tertiary level. In order to get students to be able to master the indicators of ability to understand well, it is necessary to analyze student errors in solving algebraic problems which are the basic material of mathematics education majors. So based on this background, researchers compiled this article with the aim to find out where lies the students' mistakes in solving algebraic problems.

METHOD

The study was conducted at IKIP Siliwangi, even semester of 2018-2019. This research was carried out in stages from September to December 2018. This research is classified as a qualitative descriptive study that seeks to describe students' completion analysis in answering algebraic questions. This study, the data source used in the form of written sources, divided into sources of scientific books and magazines, sources from archives, personal documents, and official documents. In this study the written and short interviews were used.

The subjects in this study were 46 students in the first semester of the Mathematics Education Study Program IKIP Siliwangi, who took General Algebra courses. Data from student answers through diagnostic test questions given. The instrument of this research includes tests and non-tests. Test instruments in the form of algebraic questions consisting of 4 description questions and non-test instruments in the form of direct interviews. The data analysis technique in this study uses the percentage of each item, short interviews and conclusions. In the percentage of each item using the percentage level classification of mathematical comprehension abilities (Suswigi & Zhanty, 2019), as in Table 1. as follows:

Tabel 1. Percentage Classification of Mathematical Understanding Ability Scores

Ability Percentage	Interpretation
0% - 34%	Very Low
35% - 54%	Low
55% - 64%	Middle
65% - 84%	High
85% - 100%	Very Low

RESULTS AND DISCUSSION

Results

Based on the results of the initial test of algebra on general algebra courses, the following are the results of the percentage test questions for mathematical comprehension skills:

Tabel 2. Percentage of Scores per Item Understanding Ability Questions

Question Item	%	Interpretation
1	63.04	Middle
2	78.26	High
3	50.54	Low
4	57.07	Middle

5	61.41	Middle
Rerata	62.07	Middle

In Table 2. the average overall number of items about comprehension ability is seen at a moderate level, with the item percentage question No. 3 still relatively low. The low interpretation is a matter of the ability of understanding with indicators identifying the characteristics of a concept and recognizing the conditions that determine a concept. This means that 2018 odd semester students have problems not being able to identify the nature and conditions of a concept that can be applied to solve the problem of comprehension abilities given. Following are the questions and some student answers to item number 3:

Problem No. 3, the indicator identifies the characteristics of a concept and recognizes the conditions that determine a concept means that here students are asked to solve the problem by applying the basic concepts to algebraic operations.

Determine the results or simplify the following division:

a. $16a^2b : 2ab$

b. $(8x^2 + 2x) : (2y^2 - y)$

Some results of student answers that have not been able to identify the concept that was applied when solving the problem number 3:

Figure 1. Student Answer 1

In Figure 1. There is clearly a question no. 3a the student answers by changing the form of division according to the problem into a fraction and then dividing the numerical coefficient with the denominator but not paying attention to the variables, while the no.3b problem of the student answers by adding $(8x^2 + 2x) = 10x^3$ and $(2y^2 - y) = 2y^3$ then share it in the same way with the technique of solving the no. 3 problem. Based on these answers, student 1 still does not understand the concept of operating algebraic problems.

Gambar 2. Student Answer 2

In Figure 2. Seen student 2 only answers question number 3 without using a clear work method, by producing directly $(8a)$. while the no.3b problem of the student seems to only write the questions given without producing any answers. Based on these answers, student 2 only remembers the simple concept of algebra if it has the same variable, so it can be

produced, so for question no.3 the student 2 does not seem to find the answer because he sees different variables between the numerator and denominator.

$$\begin{aligned} \text{3. a) } \frac{16a^2b}{2ab} &= 8a \\ \text{b) } \frac{8x^2 + 2x}{2y^2 - y} &= \frac{4x^2 + 2x}{y^2 - y} = \frac{4x \cdot x + 2x}{y \cdot y - y} = \frac{4x + 3x}{y} \end{aligned}$$

Gambar 3. Student Answer 3

In Figure 3. The student's answer 3 is the same as student 2 except that the form of the division becomes a fraction so that the results are more clear, 8a. while the answer to question no.3 of the student is working by dividing the numerical coefficient with the denominator coefficient but it is still wrong because the student does not pay attention to the variable coefficient (y), which only has a coefficient (1) so there is no possible coefficient (y²) can be divided by the numerical coefficient. Another error is to consider co-efficient between the variables so that (4x.x + 2x = 4x + 3x). Based on these explanations the students understood the algebraic concept still not mastered.

$$\begin{aligned} \text{3. a) } 16a^2b : 2ab &= \frac{16a^2b}{2ab} = 8a \\ \text{b) } (8x^2 + 2x) : (2y^2 - y) &= \frac{8x^2 + 2x}{2y^2 - y} = \frac{4x^2 + 2x}{y^2 - y} \end{aligned}$$

Gambar 4. Student Answer 4

In Figure 4. Student's answer 4 looks the same as the previous student's answer. Especially the question number 3, but there are different students. The difference is, the student in detail writes the answers obtained. Whereas the answer from the no.3b problem, there is an error by considering the same concept that is applied, that is, directly dividing it without looking at the different form of the problem with the question no. based on the details of the answers, it can be concluded that these students still do not understand the concept of algebra as a whole.

$$\begin{aligned} \text{3. a. } 16a^2b : 2ab &= 8a \\ \text{b. } (8x^2 + 2x) : (2y^2 - y) &= \frac{4x^2}{y^2} - \frac{0x^2}{y} + \frac{x}{y^2} - \frac{2x}{y} \end{aligned}$$

Gambar 5. Student Answer 5

In Figure 5. The student is seen to answer almost the same as the previous student's answer but the difference is answered by the no. 3 question, the student already understands the meaning of the sign of division and divides it directly with the right answer. However, for the results of answer number no.3, there is still a misunderstanding of the algebraic concept whose sum is summarized by comparison and changing it into a form of fraction addition, but the student cannot produce anything. Based on this, students still cannot understand the concepts that must be applied to different algebraic questions.

Discussion

Based on the analysis of student errors in completing algebraic questions, the researcher proceeded to conduct a brief interview directly to the students concerned. It is useful to clarify the factors that influence the results of answers and expectations while researchers about students do not understand the concept of algebraic operations properly. The following results of interviews were obtained from several students in the form of reasons, including: (1) lack of understanding of algebraic operations or confusion about how to operate symbols (variables) in the problem, (2) algebraic operations can only be completed if the variables are the same (3) in algebraic operations if there are numbers (coefficients) then they can be solved like ordinary number operations so that the same thing can be done for the same variable, (4) the division operations in algebraic forms can only be completed if they have variable similarities, so if there are no similarities enough numbers (coefficient) only, and (5) I think if the concept of ordinary fraction operation as $\frac{2+3}{5} = \frac{2}{5} + \frac{3}{5}$ it can also apply to the algebraic form.

Based on the results of a short interview directly on each student who answered the question no.3 is not perfect. The researcher concluded that there were erroneous concepts understood by the students so that the students were wrong in completing the algebraic form given. So that the initial allegations at the beginning proved to be true that students have problems (constraints) in applying the concept of operating algebraic forms. This is in line with research Puspitasari et al. (2017) Based on the results of a short interview directly on each student who answered the question no.3 is not perfect. The researcher concluded that there were erroneous concepts understood by the students so that the students were wrong in completing the algebraic form given. So that the initial allegations at the beginning proved to be true that students have problems (constraints) in applying the concept of operating algebraic forms. This is in line with research Jalaludin & Sari (2018) also concluded that in solving number problems the rank of making a concept error, understanding the problem, and calculating due to students' understanding ability is low in mastering the concept.

CONCLUSION

The conclusion of the analysis of comprehension ability is based on the answers of five mathematics students about solving algebraic forms, namely (1) not understanding the concept of operating algebraic problems, (2) understanding common division operations with algebraic distribution operations, (3) understanding the algebraic concept master, (4) still do not understand the concept of algebra as a whole, and (5) still cannot understand the concepts that must be applied to different algebraic questions. The essence of the ability is still low understanding, especially on indicators identifying the characteristics of a concept and recognize the conditions that determine a concept. Overall because students do not understand

the concept of algebra in depth, which is caused by the meaninglessness of the learning process that is passed. So that the concept that might have been given well in school, could be lost even wrong in applying it.

It is recommended for future researchers to use a more meaningful learning strategy or approach in order to improve understanding skills which are the basis of other abilities.

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